

cylinder head while pushing the cylinder head down into position.

14. Tie the wire attached to the cam chain to the exterior of the engine.

15. Install the Allen bolts and copper washers (A, **Figure 45**) and the cap nuts and steel washers (B, **Figure 45**).

16. Tighten the Allen bolts and cap nuts in the torque pattern shown in **Figure 47**. Tighten to the torque specifications listed in **Table 2**.

17. Install the exhaust system in to the cylinder head as described in Chapter Seven.

18. Install the cylinder head cover and camshaft as described in this chapter.

19. Adjust the valves as described in Chapter Three.

Disassembly/Inspection/Assembly

Because the cylinder head and cylinder head cover are machined as a set during manufacture, they must be replaced as a set if either is damaged or defective.

1. Remove all traces of gasket material from the cylinder head mating surfaces.

2. *Without removing the valves*, remove all carbon deposits from the combustion chamber (**Figure 48**) and valve ports with a wire brush. A blunt screwdriver or chisel may be used if care is taken not to damage the head, valves and spark plug threads.

3. After the carbon is removed from the combustion chamber and the valve intake and exhaust ports, clean the entire head in cleaning solvent. Blow dry with compressed air.

4. Clean away all carbon from the piston crown. Do not remove the carbon ridge at the top of the cylinder bore.

5. Check for cracks in the combustion chamber and exhaust ports. A cracked head must be replaced.

6. After the head has been thoroughly cleaned, place a straightedge across the cylinder head/cylinder gasket surface (**Figure 49**) at several points. Measure the warp by inserting a flat feeler gauge between the straightedge and the cylinder head at each location. There should be no warpage; if a small amount is present, it can be resurfaced by a dealer or qualified machine shop. Replace the cylinder head and cylinder head cover as a set if the gasket surface is warped to or beyond the limit listed in **Table 1**.

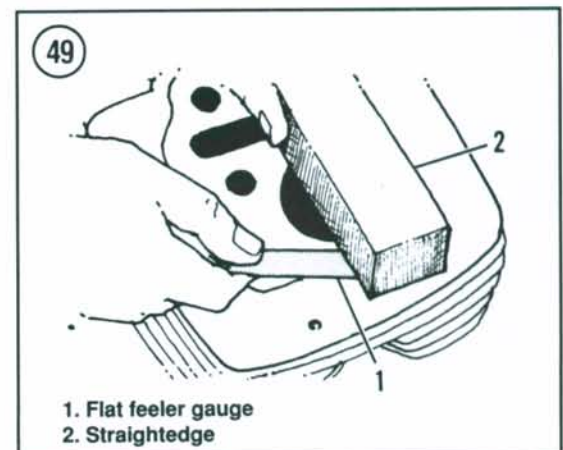
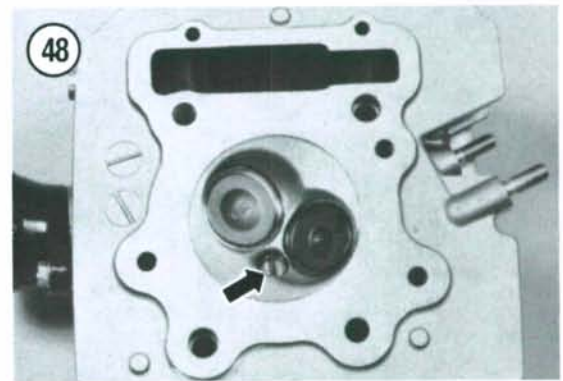
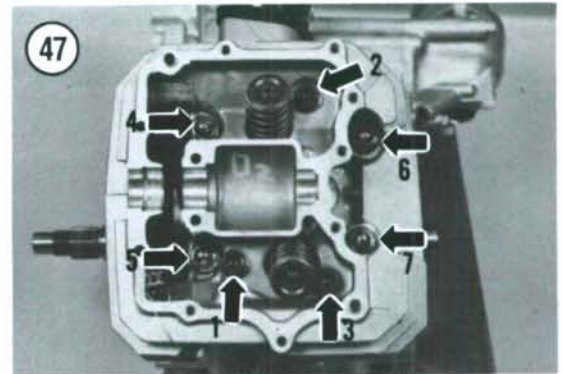
7. Check the cylinder head cover mating surface using the procedure in Step 6. There should be no warpage.

8. Check the valves and valve guides as described in this chapter.

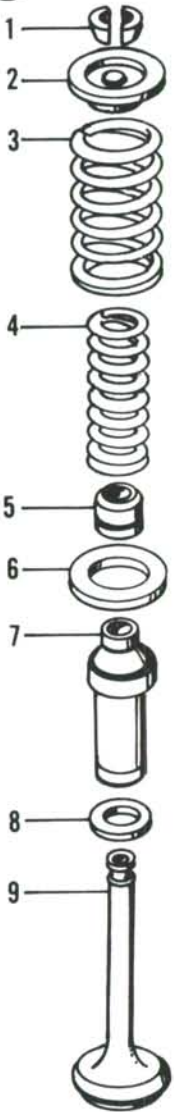
VALVES AND VALVE COMPONENTS

Removal

Refer to **Figure 50** for this procedure.



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VALVE COMPONENTS

1. Keepers
2. Valve spring retainer
3. Outer spring
4. Inner spring
5. Valve stem seal
6. Spring seal
7. Valve guide
8. O-ring
9. Valve

1. Remove the cylinder head as described in this chapter.

CAUTION

To avoid loss of spring tension, do not compress the springs any more than necessary to remove the keepers.

2. Compress the valve springs with a valve compressor tool (**Figure 51**). Remove the valve keepers (**Figure 52**) and release the compression. Remove the valve compressor tool.

3. Remove the valve spring retainer and valve springs (**Figure 53**).

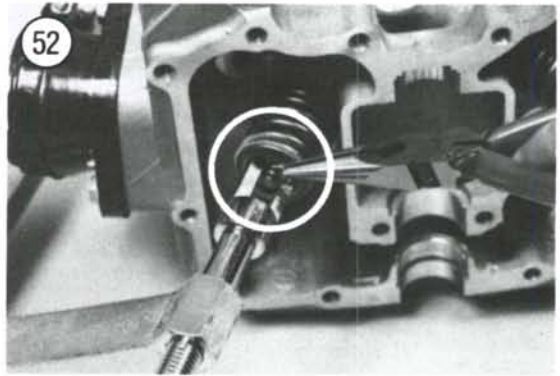
NOTE

*The valve spring seat and valve stem seal will stay in the cylinder head (**Figure 54**).*

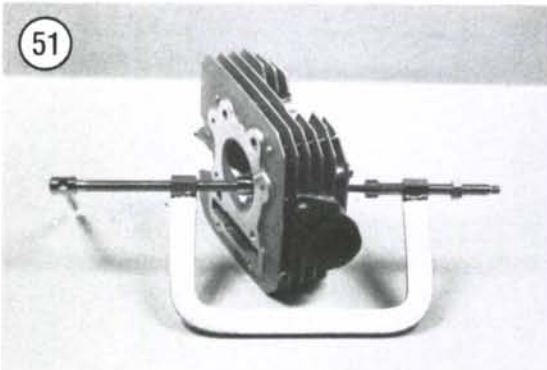
4. Prior to removing the valve, remove any burrs from the valve stem (**Figure 55**). Otherwise the valve guide will be damaged.

5. Mark all parts as they are disassembled so that they will be installed in their original locations.

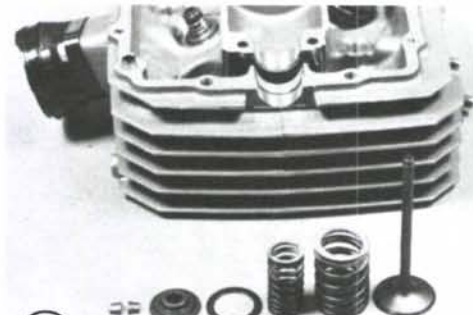
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51



53



Inspection

1. Clean valves with a wire brush and solvent.
2. Inspect the contact surface of each valve for burning or pitting. Unevenness of the contact surface is an indication that the valve is not serviceable.
3. Measure each valve seating face for wear (**Figure 56**). If worn to the service limit in **Table 1** or less, the valve must be replaced.

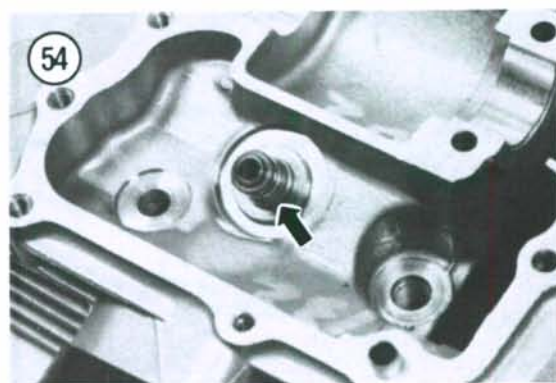
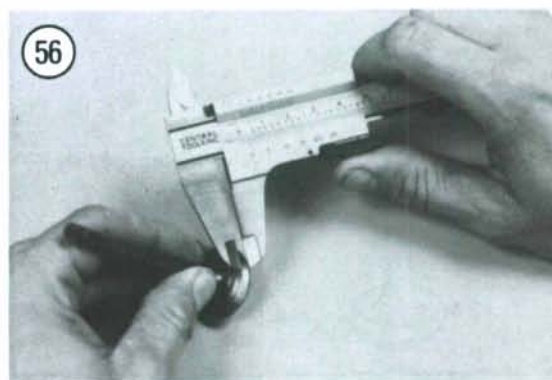
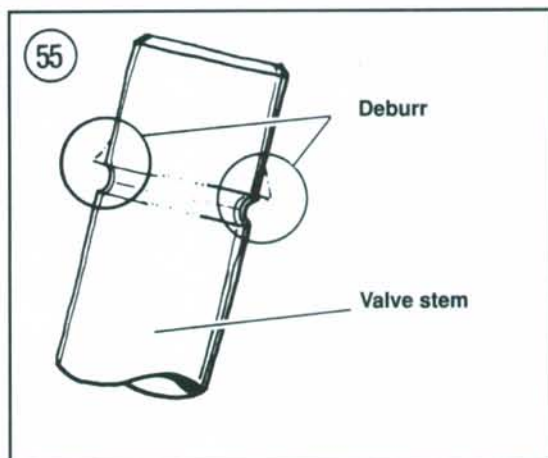
NOTE

*The valve contact surface **cannot** be ground as it has a special coating. If defective, the valve(s) must be replaced.*

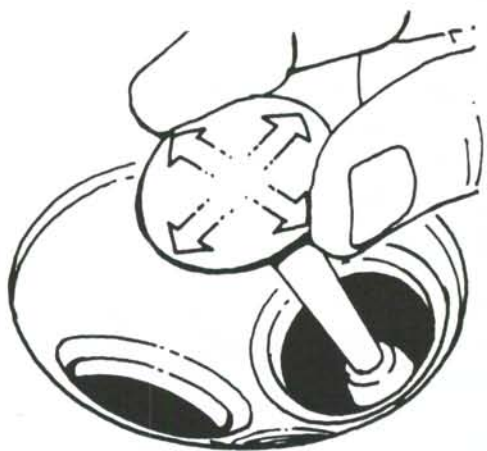
4. Measure the valve stem for wear (**Figure 57**). Compare with specifications given in **Table 1**.
5. Remove all carbon and varnish from the valve guide with a stiff spiral wire brush.
6. Insert each valve in its guide. Hold the valve just slightly off its seat and rock it sideways in 2 directions (**Figure 58**). If it rocks more than slightly, the guide is probably worn and should be replaced. If a dial indicator is available, a more accurate measurement can be made as shown in **Figure 59**. Replace any guides that exceed the valve stem-to-guide clearance specified in **Table 1**. If the guides must be replaced, take the cylinder head to a dealer or machine shop.
7. Measure each valve spring free length with a vernier caliper (**Figure 60**). All should be within the length specified in **Table 1** with no signs of bends or distortion. Replace defective springs in pairs (inner and outer).
8. Inspect each set of valve springs (**Figure 61**) for wear, distortion or damage. Replace as a set if necessary.

9. Check the valve spring retainer and valve keepers. If they are in good condition they may be reused; replace as necessary.

10. Inspect valve seats. If worn or burned, they must be reconditioned. This should be performed by your dealer or a qualified machine shop. Seats and valves in near-perfect condition can be reconditioned by lapping with a fine carborundum paste. Lapping, however, is always inferior to precision grinding.



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Installation

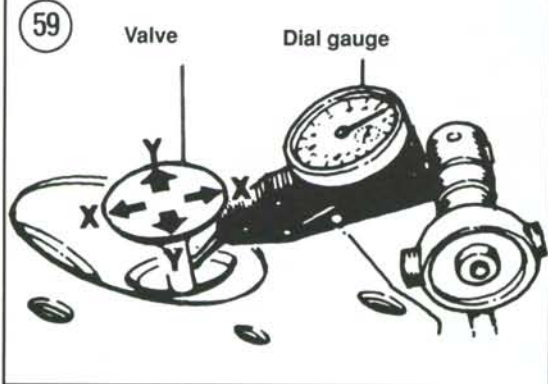
1. Coat the valve stems with molybdenum disulfide grease. To avoid damage to the valve stem seal, turn the valve slowly while inserting the valve into the cylinder head.
2. Install the valve springs with their closer wound coils (**Figure 62**) facing the cylinder head.
3. Install the valve spring retainer.

CAUTION

To avoid loss of spring tension, do not compress the springs any more than necessary to install the keepers.

4. Compress the valve springs with a compressor tool (**Figure 51**) and install the valve keepers.
5. After all springs have been installed, gently tap the end of the valve stems with a soft aluminum or brass drift and hammer. This will ensure that the keepers are properly seated.

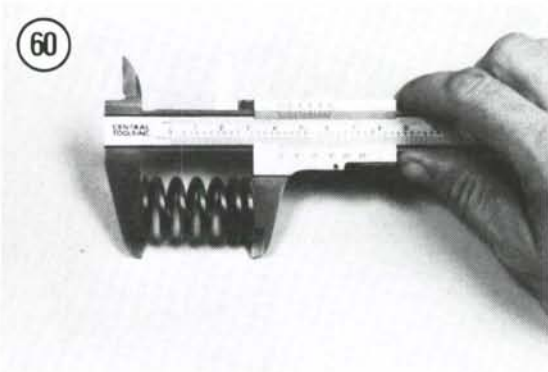
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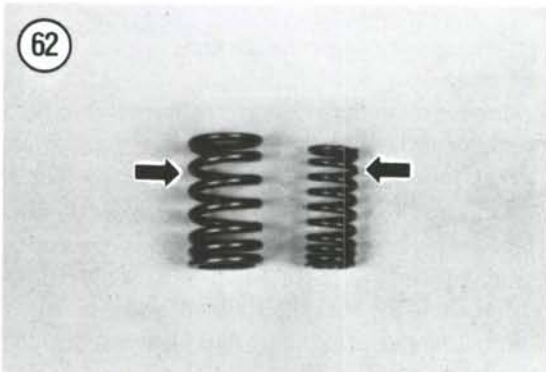
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60



62



Valve Guide Replacement

When valve guides are worn so that there is excessive valve stem-to-guide clearance or valve tipping, the guides must be replaced. This job should only be done by a dealer as special tools are required as well as considerable expertise. If the valve guide is replaced; also replace the respective valve.

The following procedure is provided if you choose to perform this task yourself.

CAUTION

*There **may** be a residual oil or solvent odor left in the oven after heating the cylinder head. If you use a household oven; first check with the person who uses the oven for food preparation to avoid getting into trouble.*

1. Remove the valve assemblies as described in this chapter.
2. Remove the clamping screw securing the intake pipe onto the cylinder head. Remove the intake pipe prior to placing the cylinder head in the oven.
3. The valve guides are installed with a slight interference fit. Place the cylinder head in a heated oven (or on a hot plate). Heat the cylinder head to a temperature between 100-150° C (212-300° F). An easy way to check the proper temperature is to drop tiny drops of water on the cylinder head; if they sizzle and evaporate immediately, the temperature is correct.

CAUTION

Do not heat the cylinder head with a torch (propane or acetylene); never bring a flame into contact with the cylinder head or valve guide. The direct heat will destroy the case hardening of the valve guide and will likely cause warpage of the cylinder head.

4. Remove the cylinder head from the oven and hold onto it with kitchen pot holders, heavy gloves or heavy shop cloths—it is very hot.
5. While heating up the cylinder head, place the new valve guides in a freezer (or refrigerator) if possible. Chilling them will slightly reduce their overall diameter while the hot cylinder head is slightly larger due to heat expansion. This will make valve guide installation much easier.

6. Turn the cylinder head upside down on wood blocks. Make sure the cylinder is properly supported on the wood blocks.

7. From the combustion chamber side of the cylinder head, drive out the old valve guide with a hammer and valve guide remover (**Figure 63**). Use Honda special tool, Valve Guide Remover, part No. 07742-0010100. Remove the special tool.

8. Remove and discard the valve guide. *Never* reinstall a valve guide that has been removed as it is no longer true nor within tolerances.

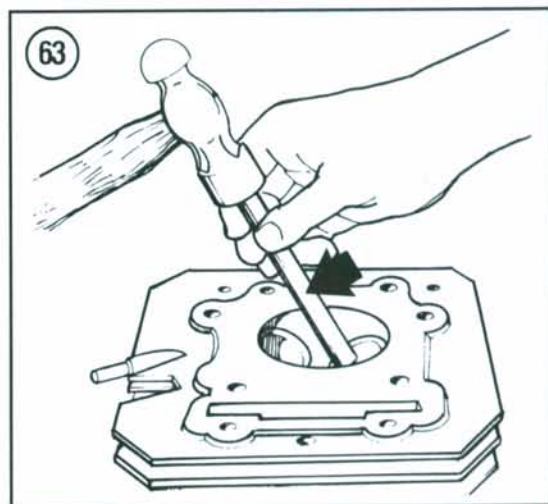
CAUTION

Failure to apply fresh engine oil to both the valve guide and the valve guide hole in the cylinder head will result in damage to the cylinder head and/or the new valve guide.

CAUTION

The cylinder must still be at the temperature indicated in Step 3 in order to install the new valve guide.

9. Install a new O-ring seal on the valve guide.
10. Apply fresh engine oil to the new valve guide, O-ring seal and to the valve guide hole in the cylinder head.
11. From the top side (camshaft side) of the cylinder head, drive in the new valve guide. Use the same Honda special tool used to remove the valve guide in Step 7 and a hammer (**Figure 64**) and drive in the new guide.
12. Allow the cylinder head to cool to room temperature.



13. After installation, ream the new valve guide as follows:

- a. Apply cutting oil to both the new valve guide and the valve guide reamer.
- b. Use Honda special tools, Valve Guide Reamer, part No. 07984-200000C and a holder similar to a thread tap holder (**Figure 65**).

CAUTION

Always rotate the valve guide reamer in the same direction when installing and removing. If the reamer is rotated in the opposite direction, damage to a good valve guide will occur.

- c. Insert the reamer from the top side and rotate the reamer. Continue to rotate the reamer and work it down through the entire length of the

new valve guide. Apply additional cutting oil during this procedure.

- d. While rotating the reamer *in the same direction*, withdraw the reamer from the valve guide.
14. If necessary, repeat Steps 1-13 for the other valve guide.
15. Thoroughly clean the cylinder head and valve guides with solvent to wash out all metal particles. Dry with compressed air.
16. Reface the valve seats as described in this chapter.
17. Install all items removed.

Valve Seat Inspection

1. Remove the valves as described in this chapter.

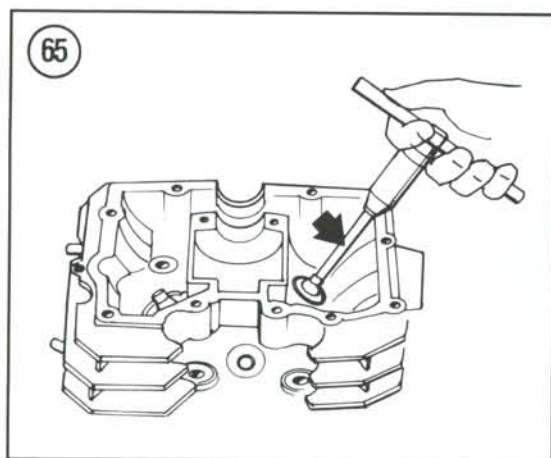
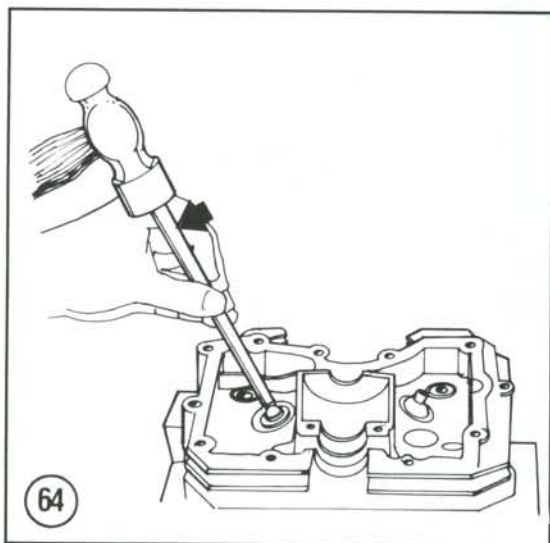
NOTE

*The contact surface of the valve **cannot be ground**; the valve must be replaced if this area is damaged.*

2. The most accurate method for checking the valve seal is to use Prussian Blue or machinist's dye, available from auto parts stores or machine shops. To check the valve seal with Prussian Blue or machinist's dye, perform the following:

- a. Thoroughly clean off all carbon deposits from the valve face with solvent or detergent, then thoroughly dry.
- b. Spread a thin layer of Prussian Blue or machinist's dye evenly on the valve face.
- c. Moisten the end of a suction cup valve tool and attach it to the valve. Insert the valve into the guide.
- d. Using the suction cup tool, *tap* the valve up and down in the cylinder head. Do *not* rotate the valve or a false indication will result.
- e. Remove the valve and examine the impression left by the Prussian Blue or machinist's dye. If the impression left in the dye (on the valve or in the cylinder head) is not even and continuous and the valve seat width (**Figure 66**) is not within specified tolerance listed in **Table 1**, the cylinder head valve seat must be reconditioned.

3. Closely examine the valve seat in the cylinder head. It should be smooth and even with a polished seating surface.



4. If the valve seat is okay, install the valves as described in this chapter.
5. If the valve seat is not correct, recondition the valve seat as described in this chapter.

Valve Seat Reconditioning

Special valve cutter tools and considerable expertise are required to properly recondition the valve seats in the cylinder head. You can save considerable money by removing the cylinder head(s) and taking just the cylinder head(s) to a dealer or machine shop and having the valve seats ground.

The following procedure is provided if you choose to perform this task yourself.

The valve seat cutters are available from a Honda dealer or from machine shop supply outlets. Follow the manufacturer's instruction with regard to operating the cutters. You will need the following cutters:

- a. 32°.
- b. 45°.
- c. 60°.

You will also need a T-handle and the solid pilot.

The valve seats for both the intake valves and exhaust valves are machined to the same angles—but *different* diameters. The valve contact surface is cut to a 45° angle and the area above the contact surface (closest to the combustion chamber) is cut to a 32° angle. The area below the contact surface (closest to the valve) is cut to a 60° angle.

1. Carefully rotate and insert the solid pilot into the valve guide. Make sure the pilot is correctly seated.
2. Using the 45° angle side of the cutter, install the cutter and the T-handle onto the solid pilot.
3. Using the 45° cutter, descale and clean the valve seat with one or two turns (**Figure 67**).

CAUTION

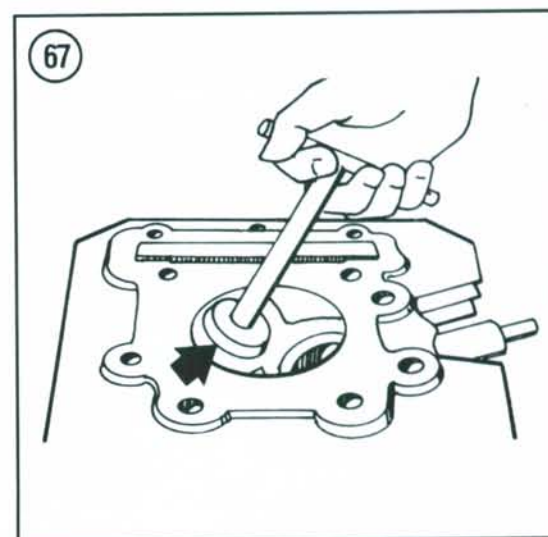
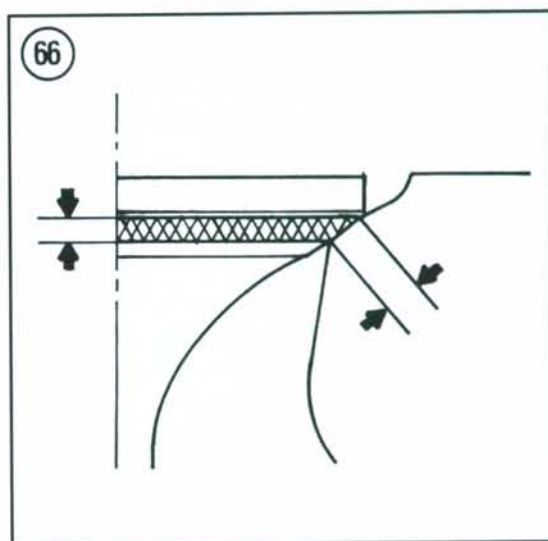
Measure the valve seat contact area in the cylinder head after each cut to make sure the contact area is correct and to prevent removing too much material. If too much material is removed, the cylinder head must be replaced.

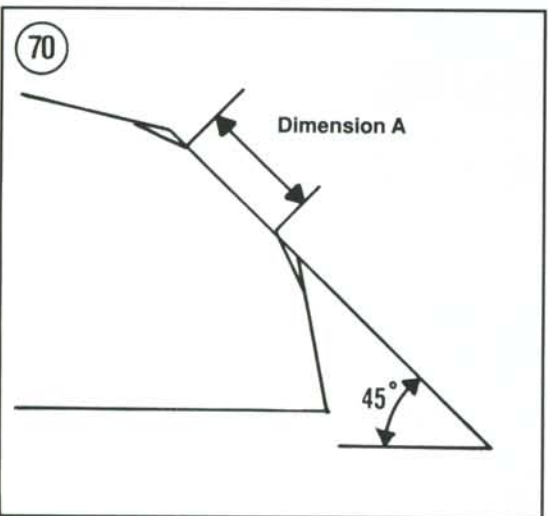
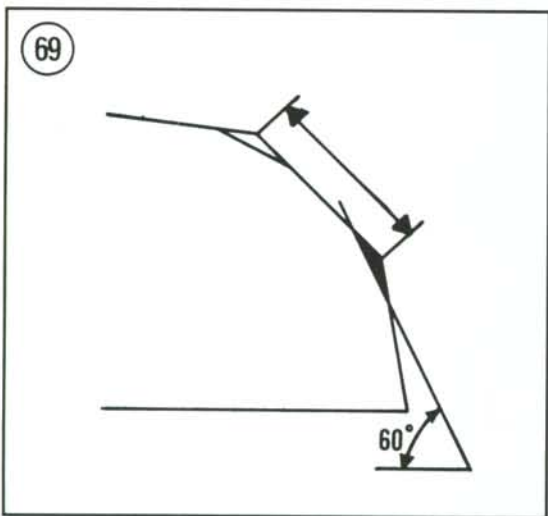
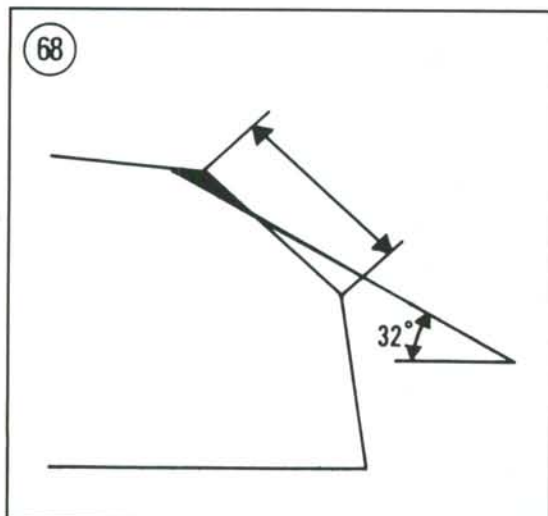
CAUTION

Remember to use the correct diameter cutter on the correct valve seat, otherwise the valve seat surface will be damaged and the cylinder head must be replaced.

4. If the seat is still pitted or burned, perform the following:

- a. Use the 32° cutter and remove a *small* amount (approximately 1/4) of the top portion of the valve seat (**Figure 68**). Remove the 32° cutter.
- b. Use the 60° cutter and remove a *small* amount (approximately 1/4) of the bottom portion of the valve seat (**Figure 69**). Remove the 60° cutter.
- c. Finally, use the 45° cutter to achieve the valve face surface of the desired width as shown in **Figure 70**. Refer to the previous CAUTION to avoid removing too much material from the cylinder head.





5. Remove the valve cutter, T-handle and solid pilot from the cylinder head.

6. Inspect the valve seat-to-valve face impression as follows:

- Spread a thin layer of Prussian Blue or machinist's dye evenly on the valve face.
- Moisten the end of a suction cup valve tool and attach it to the valve. Insert the valve into the guide.
- Using the suction cup tool, tap the valve up and down in the cylinder head. Do *not* rotate the valve or a false indication will result.
- Remove the valve and examine the impression left by the Prussian Blue or machinist's dye.

e. Measure the valve seat width as shown in

Figure 66. Refer to **Table 1** for the seat width.

7. After the final cut has been made, apply valve lapping compound and lap the valve using light pressure as described in this chapter.

8. Check that the finish has a smooth and velvety surface, it should *not* be shiny or highly polished. The final seating will take place when the engine is first run.

9. Repeat Steps 1-8 for the remaining valve seat.

10. Thoroughly clean the cylinder head and all valve components in solvent or detergent and hot water.

11. After the lapping has been completed and the valve assemblies have been reinstalled into the head, the valve seal should be tested. Check the seal of each valve by pouring solvent into each of the intake and exhaust ports. The solvent should not flow past the valve seat and the valve head. Perform on all sets of valves. If fluid leaks past any of the seats, disassemble that valve assembly and repeat the lapping procedure until there is no leakage.

12. If the cylinder head and valve components were cleaned in detergent and hot water, apply a light coat of engine oil to all bare metal surfaces to prevent any rust formations.

Valve Lapping

Valve lapping is a simple operation which can restore the valve seal without machining if the amount of wear or distortion is not too great.

1. Coat the valve seating area in the head with a lapping compound such as Carborundum or Clover Brand.

2. Insert the valve into the cylinder head.

3. Wet the suction cup of the lapping stick and stick it onto the head of the valve. Lap the valve to the seat by rotating the lapping stick in both directions (**Figure 71**). Every 5 to 10 seconds, rotate the valve 180° in the valve seat; continue lapping until the contact surfaces of the valve and the valve seat are a uniform grey. Stop as soon as they are, to avoid removing too much material.

4. Thoroughly clean the cylinder head and all valve components in solvent or detergent and hot water to remove all grinding compound. Any compound left on the valves or the cylinder head will end up in the engine and will cause damage.

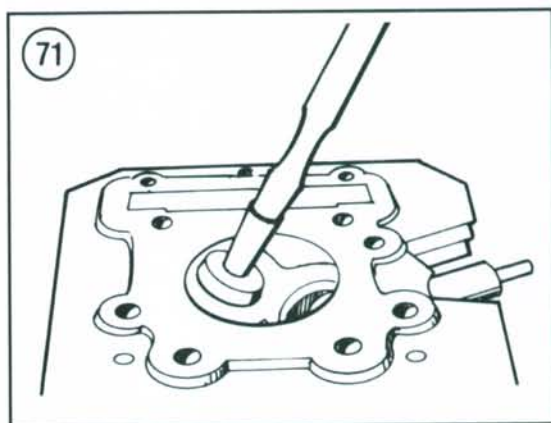
5. After the lapping has been completed and the valve assemblies have been reinstalled into the head, the valve seal should be tested. Check the seal of each valve by pouring solvent into each of the intake and exhaust ports. The solvent should not flow past the valve seat and the valve head. Perform on all sets of valves. If fluid leaks past any of the seats, disassemble that valve assembly and repeat the lapping procedure until there is no leakage.

6. If the cylinder head and valve components were cleaned in detergent and hot water, apply a light coat of engine oil to all bare metal surfaces to prevent any rust formations.

may be purchased or may be a homemade unit of wood. See **Figure 74** for dimensions.

Inspection

The following procedure requires the use of highly specialized and expensive measuring instruments. If such equipment is not readily available,



CYLINDER

Removal

1. Remove the cylinder head cover and camshaft and the cylinder head as described in this chapter.

2. Remove the camshaft chain slipper (**Figure 72**).

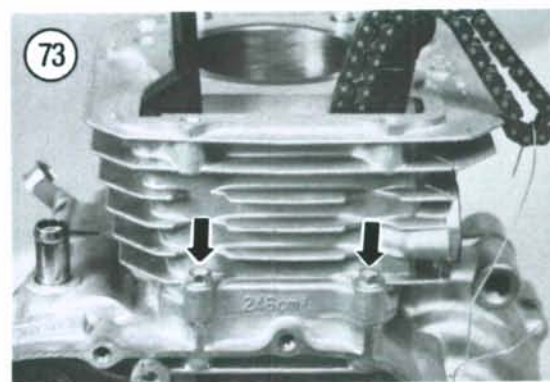
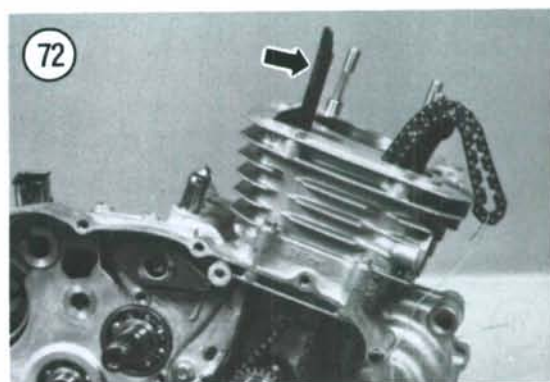
3. Remove the bolts (**Figure 73**) on the right-hand side of the cylinder.

4. Loosen the cylinder by tapping around the perimeter with a rubber or plastic mallet. If necessary, gently pry the cylinder loose with a broad-tipped screwdriver.

5. Pull the cylinder straight out and off of the crankcase studs. Work the cam chain wire through the opening in the cylinder and retie the wire to the crankcase so the chain will not fall into the crankcase.

6. Remove the cylinder base gasket and discard it. Remove the dowel pins from the crankcase studs.

7. Install a piston holding fixture under the piston to protect the piston skirt from damage. This fixture



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